WHAT IS CLAIMED IS:

1.   An audio signal encoding apparatus for dividing audio signal into a plurality of audio signal components each corresponding to a scale factor band to be encoded in accordance with a predetermined psychoacoustic model, comprising:

inputting means for inputting said audio signal therein;

frame length determining means for judging whether said audio signal inputted from said inputting means is transient or stationary, and determining a short-length frame for said audio signal when it is judged that said audio signal is transient and a long-length frame for said audio signal when it is judged that said audio signal is stationary;

FFT analyzing means for performing the fast Fourier transform to said audio signal inputted from said inputting means to generate frequency information about said audio signal;

coded mode information inputting means for inputting coded mode information;

psychoacoustic model analyzing means for calculating Signal-to-Mask ratio information for said audio signal on the basis of said frequency information about said audio signal generated by said FFT analyzing means, in accordance with said predetermined psychoacoustic model;

maximum scale factor band table storage means for storing initial maximum scale factor band information and Signal-to-Mask ratio threshold value information;

initial maximum scale factor band calculation means for calculating an initial maximum scale factor band for said audio signal on the basis of the result made by said frame length determining means and said coded mode information inputted from said coded mode information inputting means with reference to said initial maximum scale factor band information and said Signal-to-Mask ratio threshold value information stored in said maximum scale factor band table storage means;

maximum scale factor band calculation means for calculating a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band calculated by said initial maximum scale factor band calculation means in accordance with said Signal-to-Mask ratio information calculated by said psychoacoustic model analyzing means;

spectral processing means for dividing said audio signal inputted from said inputting means into a plurality of audio signal components each corresponding to a

37

scale factor band, and performing spectral processing to said audio signal components up to an audio signal component corresponding to said maximum scale factor band calculated by said maximum scale factor band calculation means, on the basis of said Signal-to-Mask ratio information calculated by said psychoacoustic model analyzing means to generate audio signal data; and

quantizing and encoding means for quantizing and encoding said audio signal data generated by said spectral processing means to generate a coded audio signal to be outputted therethrough,

whereby said maximum scale factor band calculation means is operative to adaptively calculate said maximum scale factor band in response to said audio signal inputted therein.

2.   An audio signal encoding apparatus as set forth in claim 1, in which said coded mode information includes bit rate information and sampling frequency information, said maximum scale factor band table storage means is operative to store initial maximum scale factor band information having a plurality of scale factor bands in relation to the bit rate information and the sampling frequency information and Signal-to-Mask ratio threshold value information having a plurality of Signal-to-Mask ratio threshold values in relation to the bit rate information and the sampling frequency information, said initial maximum scale factor band calculation means is operative to calculate an initial maximum scale factor band for said audio signal on the basis of the result made by said frame length determining means and said coded mode information including said bit rate information and said sampling frequency information inputted from said coded mode information inputting means with reference to said initial maximum scale factor band information and Signal-to-Mask ratio threshold value information stored in said maximum scale factor band table storage means, and said maximum scale factor band calculation means is operative to calculate a maximum scale factor band for said audio signal on the basis of said Signal-to-Mask ratio information calculated by said psychoacoustic model analyzing means and said initial maximum scale factor band calculated by said initial maximum scale factor band calculation means.

3.   An audio signal encoding apparatus as set forth in claim 2, in which said coded mode information further includes the number of channels, said maximum scale factor band table storage means is operative to store initial maximum scale factor band information having a plurality of scale factor bands in relation to the number of

channels and Signal-to-Mask ratio threshold value information having a plurality of Signal-to-Mask ratio threshold values in relation to the number of channels, said initial maximum scale factor band calculation means is operative to calculate an initial maximum scale factor band for said audio signal on the basis of the result made by said frame length determining means and said coded mode information including the number of channels inputted from said coded mode information inputting means with reference to said initial maximum scale factor band information and Signal-to-Mask ratio threshold value information stored in said maximum scale factor band table storage means, and said maximum scale factor band calculation means is operative to calculate a maximum scale factor band for said audio signal on the basis of said Signal-to-Mask ratio information calculated by said psychoacoustic model analyzing means and said initial maximum scale factor band calculated by said initial maximum scale factor band calculation means.

4.   An audio signal encoding apparatus as set forth in claim 1, in which said Signal-to-Mask ratio information includes a Signal-to-Mask ratio table showing a relationship between a plurality of Signal-to-Mask ratios and scale factor bands, said maximum scale factor band table storage means is operative to store initial maximum scale factor band information and Signal-to-Mask ratio threshold value information, said initial maximum scale factor band calculation means is operative to calculate an initial maximum scale factor band and a Signal-to-Mask ratio threshold value for said audio signal on the basis of the result made by said frame length determining means and said coded mode information inputted from said coded mode information inputting means with reference to said initial maximum scale factor band information and said Signal-to-Mask ratio threshold value information stored in said maximum scale factor band table storage means, and said maximum scale factor band calculation means is operative to calculate a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band and said Signal-to-Mask ratio threshold value calculated by said initial maximum scale factor band calculation means in accordance with said Signal-to-Mask ratio table showing a relationship between Signal-to-Mask ratios and scale factor bands included in said Signal-to-Mask ratio information calculated by said psychoacoustic model analyzing means through the steps of:

(1)   determining a Signal-to-Mask ratio corresponding to a maximum scale factor band in accordance with said Signal-to-Mask ratio table wherein the initial value of said maximum scale factor band is said initial maximum scale factor band calculated by said initial maximum scale factor band calculation means;

(2)   judging whether said Signal-to-Mask ratio determined in said step (1) is greater than said Signal-to-Mask ratio threshold value;

(2-1)   decrementing said maximum scale factor band by one and returning to said step (1) if it is judged that said Signal-to-Mask ratio is not greater than said Signal-to-Mask ratio threshold value in said step (2);

(3)   repeating said step (1) to step (2-1) until it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value in said step (2);

(4)   incrementing said maximum scale factor band by one if it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value in said step (2); and

(5)   outputting said maximum scale factor band thus incremented by one in said step (4) to said spectral processing means.

5.   An audio signal encoding apparatus as set forth in claim 1, in which said maximum scale factor band table storage means is operative to store initial maximum scale factor band information and energy threshold value information, said initial maximum scale factor band calculation means is operative to calculate an initial maximum scale factor band and an energy threshold value for said audio signal on the basis of the result made by said frame length determining means and said coded mode information inputted from said coded mode information inputting means with reference to said initial maximum scale factor band information and said energy threshold value information stored in said maximum scale factor band table storage means, and said maximum scale factor band calculation means is operative to calculate an energy value table showing a relationship between a plurality of energy values and scale factor bands on the basis of said frequency information generated by said FFT analyzing means, and to calculate a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band and said energy threshold value calculated by said initial maximum scale factor band calculation means with reference to said energy value table showing a relationship between energy values and scale factor bands through the steps of:

(1)   determining an energy value corresponding to a maximum scale factor band in accordance with said energy value table wherein said initial value of said maximum scale factor band is said initial maximum scale factor band calculated by said initial maximum scale factor band calculation means;

(2)   judging whether said energy value determined in said step (1) is greater than said energy threshold value;

40

(2-1)   decrementing said maximum scale factor band by one and returning to said step (1) if it is judged that said energy value is not greater than said energy threshold value in said step (2);

(3)   repeating said step (1) and step (2-1) until it is judged that said energy value is greater than said energy threshold value in said step (2);

(4)   incrementing said maximum scale factor band by one if it is judged that said energy value is greater than said energy threshold value in said step (2), and

(5)   outputting said maximum scale factor band thus incremented by one in said step (4) to said spectral processing means.

6.   An audio signal encoding apparatus as set forth in claim 1, in which said Signal-to-Mask ratio information includes a Signal-to-Mask ratio table showing a relationship between a plurality of Signal-to-Mask ratios and scale factor bands, said maximum scale factor band table storage means is operative to store initial maximum scale factor band information, Signal-to-Mask ratio threshold value information, and minimum scale factor band information, said initial maximum scale factor band calculation means is operative to calculate an initial maximum scale factor band, a Signal-to-Mask ratio threshold value, and a minimum scale factor band for said audio signal on the basis of the result made by said frame length determining means and said coded mode information inputted from said coded mode information inputting means with reference to said initial maximum scale factor band information, said Signal-to-Mask ratio threshold value information, and said minimum scale factor band information stored in said maximum scale factor band table storage means, and said maximum scale factor band calculation means is operative to calculate a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band, said Signal-to-Mask ratio threshold value, and said minimum scale factor band calculated by said initial maximum scale factor band calculation means in accordance with said Signal-to-Mask ratio table showing a relationship between Signal-to-Mask ratio and scale factor bands included in said Signal-to-Mask ratio information calculated by said psychoacoustic model analyzing means through the steps of:

(1)   determining a Signal-to-Mask ratio corresponding to a maximum scale factor band in accordance with said Signal-to-Mask ratio table wherein the initial value of said maximum scale factor band is said initial maximum scale factor band calculated by said initial maximum scale factor band calculation means;

(2)   judging whether said Signal-to-Mask ratio determined in said step (1) is greater than said Signal-to-Mask ratio threshold value;

41

(2-1)   decrementing said maximum scale factor band by one if it is judged that said Signal-to-Mask ratio is not greater than said Signal-to-Mask ratio threshold value in said step (2);

(3)   repeating said step (1) to step (2-1) until it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value in said step (2);

(4)   incrementing said maximum scale factor band by one if it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value in said step (2);

(5)   judging whether said maximum scale factor band thus incremented by one in said step (4) is less than said minimum scale factor band;

(6)   incrementing said minimum scale factor band by one, replacing said maximum scale factor band with said minimum scale factor band thus incremented by one, and outputting said maximum scale factor band thus replaced to said spectral processing means if is judged that said maximum scale factor band is less than said minimum scale factor band in said step (5); and

(7)   outputting said maximum scale factor band to said spectral processing means if it is judged that said maximum scale factor band is not less than said minimum scale factor band in said step (5).

7.   An audio signal encoding method of dividing audio signal into a plurality of audio signal components each corresponding to a scale factor band to be encoded in accordance with a predetermined psychoacoustic model, comprising the steps of:

(A)   inputting said audio signal therein;

(B)   judging whether said audio signal inputted in said step (A) is transient or stationary, and determining a short-length frame for said audio signal when it is judged that said audio signal is transient and a long-length frame for said audio signal when it is judged that said audio signal is stationary;

(C)   performing the fast Fourier transform to said audio signal inputted in said step (A) to generate frequency information about said audio signal;

(D)   inputting coded mode information;

(E)   calculating Signal-to-Mask ratio information for said audio signal on the basis of said frequency information about said audio signal generated in said step (C), in accordance with said predetermined psychoacoustic model;

(F)   storing initial maximum scale factor band information and Signal-to-Mask ratio threshold value information;

(G)   calculating an initial maximum scale factor band for said audio signal on the

42

basis of the result made in said step (B) and said coded mode information inputted in said step (D) with reference to said initial maximum scale factor band information and said Signal-to-Mask ratio threshold value information stored in said step (F);

(H)   calculating a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band calculated in said step (G) in accordance with said Signal-to-Mask ratio information calculated in said step (E);

(I)   dividing said audio signal inputted in said step (A) into a plurality of audio signal components each corresponding to a scale factor band, and performing spectral processing to said audio signal components up to an audio signal component corresponding to said maximum scale factor band calculated in said step (H), on the basis of said Signal-to-Mask ratio information calculated in said step (E) to generate audio signal data; and

(J)   quantizing and encoding said audio signal data generated in said step (I) to generate a coded audio signal to be outputted therethrough.

8.   An audio signal encoding method as set forth in claim 7, in which said coded mode information includes bit rate information and sampling frequency information, said step (F) has the step of storing initial maximum scale factor band information having a plurality of scale factor bands in relation to the bit rate information and the sampling frequency information and Signal-to-Mask ratio threshold value information having a plurality of Signal-to-Mask ratio threshold values in relation to the bit rate information and the sampling frequency information, said step (G) has the step of calculating an initial maximum scale factor band for said audio signal on the basis of the result made in said step (B) and said coded mode information including said bit rate information and said sampling frequency information inputted in said step (D) with reference to said initial maximum scale factor band information and Signal-to-Mask ratio threshold value information stored in said step (F), and said step (H) has the step of calculating a maximum scale factor band for said audio signal on the basis of said Signal-to-Mask ratio information calculated in said step (E) and said initial maximum scale factor band calculated in said step (G).

9.   An audio signal encoding method as set forth in claim 8, in which said coded mode information further includes the number of channels, said step (F) has the step of storing initial maximum scale factor band information having a plurality of scale factor bands in relation to the number of channels and Signal-to-Mask ratio threshold value information having a plurality of Signal-to-Mask ratio threshold values in relation to the

number of channels, said step (G) has the step of calculating an initial maximum scale factor band for said audio signal on the basis of the result made in said step (B) and said coded mode information including the number of channels inputted in said step (D) with reference to said initial maximum scale factor band information and Signal-to-Mask ratio threshold value information stored in said step (F), and said step (H) has the step of calculating a maximum scale factor band for said audio signal on the basis of said Signal-to-Mask ratio information calculated in said step (E) and said initial maximum scale factor band calculated in said step (G).

10.   An audio signal encoding method as set forth in claim 7, in which said Signal-to-Mask ratio information includes a Signal-to-Mask ratio table showing a relationship between a plurality of Signal-to-Mask ratios and scale factor bands, said step (F) has the step of storing initial maximum scale factor band information and Signal-to-Mask ratio threshold value information, said step (G) has the step of calculating an initial maximum scale factor band and a Signal-to-Mask ratio threshold value for said audio signal on the basis of the result made in said step (B) and said coded mode information inputted in said step (D) with reference to said initial maximum scale factor band information and said Signal-to-Mask ratio threshold value information stored in said step (F), and said step (H) has the step of calculating a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band and said Signal-to-Mask ratio threshold value calculated in said step (G) in accordance with said Signal-to-Mask ratio table showing a relationship between Signal-to-Mask ratios and scale factor bands included in said Signal-to-Mask ratio information calculated in said step (E) through the steps of:

(H-1)   determining a Signal-to-Mask ratio corresponding to a maximum scale factor band in accordance with said Signal-to-Mask ratio table wherein the initial value of said maximum scale factor band is said initial maximum scale factor band calculated in said step (G);

(H-2)   judging whether said Signal-to-Mask ratio determined in said step (H-1) is greater than said Signal-to-Mask ratio threshold value;

(H-2-1) decrementing said maximum scale factor band by one and returning to said step (H-1) if it is judged that said Signal-to-Mask ratio is not greater than said Signal-to-Mask ratio threshold value in said step (H-2);

(H-3)   repeating said step (H-1) to step (H-2-1) until it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value in said step (H-2);

(H-4)   incrementing said maximum scale factor band by one if it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value in said step (H-2); and

(H-5)   outputting said maximum scale factor band thus incremented by one in said step (H-4) to said step (I).

11.   An audio signal encoding method as set forth in claim 7, in which said step (F) has the step of storing initial maximum scale factor band information and energy threshold value information, said step (G) has the step of calculating an initial maximum scale factor band and an energy threshold value for said audio signal on the basis of the result made in said step (B) and said coded mode information inputted in said step (D) with reference to said initial maximum scale factor band information and said energy threshold value information stored in said step (F), and said step (H) has the step of calculating an energy value table showing a relationship between a plurality of energy values and scale factor bands on the basis of said frequency information generated in said step (C), and calculating a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band and said energy threshold value calculated in said step (G) with reference to said energy value table showing a relationship between energy values and scale factor bands through the steps of:

(H-1)   determining an energy value corresponding to a maximum scale factor band in accordance with said energy value table wherein said initial value of said maximum scale factor band is said initial maximum scale factor band calculated in said step (G);

(H-2)   judging whether said energy value determined in said step (H-1) is greater than said energy threshold value;

(H-2-1) decrementing said maximum scale factor band by one and returning to said step (H-1) if it is judged that said energy value is not greater than said energy threshold value in said step (H-2);

(H-3)   repeating said step (H-1) and step (H-2-1) until it is judged that said energy value is greater than said energy threshold value in said step (H-2);

(H-4)   incrementing said maximum scale factor band by one if it is judged that said energy value is greater than said energy threshold value in said step (H-2), and

(H-5)   outputting said maximum scale factor band thus incremented by one in said step (H-4) to said step (I).

12.   An audio signal encoding method as set forth in claim 7, in which said Signal-to-Mask ratio information includes a Signal-to-Mask ratio table showing a

45

relationship between a plurality of Signal-to-Mask ratios and scale factor bands, said step (F) has the step of storing initial maximum scale factor band information, Signal-to-Mask ratio threshold value information, and minimum scale factor band information, said step (G) has the step of calculating an initial maximum scale factor band, a Signal-to-Mask ratio threshold value, and a minimum scale factor band for said audio signal on the basis of the result made in said step (B) and said coded mode information inputted in said step (D) with reference to said initial maximum scale factor band information, said Signal-to-Mask ratio threshold value information, and said minimum scale factor band information stored in said step (F), and said step (H) has the step of calculating a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band, said Signal-to-Mask ratio threshold value, and said minimum scale factor band calculated in said step (G) in accordance with said Signal-to-Mask ratio table showing a relationship between Signal-to-Mask ratio and scale factor bands included in said Signal-to-Mask ratio information calculated in said step (E) through the steps of:

(H-1)   determining a Signal-to-Mask ratio corresponding to a maximum scale factor band in accordance with said Signal-to-Mask ratio table wherein the initial value of said maximum scale factor band is said initial maximum scale factor band calculated in said step (G);

(H-2)   judging whether said Signal-to-Mask ratio determined in said step (H-1) is greater than said Signal-to-Mask ratio threshold value;

(H-2-1) decrementing said maximum scale factor band by one if it is judged that said Signal-to-Mask ratio is not greater than said Signal-to-Mask ratio threshold value in said step (H-2);

(H-3)   repeating said step (H-1) to step (H-2-1) until it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value in said step (H-2);

(H-4)   incrementing said maximum scale factor band by one if it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value in said step (H-2);

(H-5)   judging whether said maximum scale factor band thus incremented by one in said step (H-4) is less than said minimum scale factor band;

(H-6)   incrementing said minimum scale factor band by one, replacing said maximum scale factor band with said minimum scale factor band thus incremented by one, and outputting said maximum scale factor band thus replaced to said step (I) if is judged that said maximum scale factor band is less than said minimum scale factor band in said step

46

(H-5); and

(H-7)   outputting said maximum scale factor band to said step (I) if it is judged that said maximum scale factor band is not less than said minimum scale factor band in said step (H-5).

13.   An audio signal encoding computer program product comprising a computer usable storage medium having computer readable code embodied therein for dividing audio signal into a plurality of audio signal components each corresponding to a scale factor band to be encoded in accordance with a predetermined psychoacoustic model, comprising:

(A)   computer readable program code for inputting said audio signal therein;

(B)   computer readable program code for judging whether said audio signal inputted by said computer readable program code (A) is transient or stationary, and determining a short-length frame for said audio signal when it is judged that said audio signal is transient and a long-length frame for said audio signal when it is judged that said audio signal is stationary;

(C)   computer readable program code for performing the fast Fourier transform to said audio signal inputted by said computer readable program code (A) to generate frequency information about said audio signal;

(D)   computer readable program code for inputting coded mode information;

(E)   computer readable program code for calculating Signal-to-Mask ratio information for said audio signal on the basis of said frequency information about said audio signal generated by said computer readable program code (C), in accordance with said predetermined psychoacoustic model;

(F)   computer readable program code for storing initial maximum scale factor band information and Signal-to-Mask ratio threshold value information;

(G)   .computer readable program code for calculating an initial maximum scale factor band for said audio signal on the basis of the result made by said computer readable program code (B) and said coded mode information inputted by said computer readable program code (D) with reference to said initial maximum scale factor band information and said Signal-to-Mask ratio threshold value information stored by said computer readable program code (F);

(H)   computer readable program code for calculating a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band calculated by said computer readable program code (G) in accordance with said Signal-to-Mask ratio information calculated by said computer readable program code (E);

47

(I)   computer readable program code for dividing said audio signal inputted by said computer readable program code (A) into a plurality of audio signal components each corresponding to a scale factor band, and performing spectral processing to said audio signal components up to an audio signal component corresponding to said maximum scale factor band calculated by said computer readable program code (H), on the basis of said Signal-to-Mask ratio information calculated by said computer readable program code (E) to generate audio signal data; and

(J)   computer readable program code for quantizing and encoding said audio signal data generated by said computer readable program code (I) to generate a coded audio signal to be outputted therethrough.

14.   An audio signal encoding computer program product as set forth in claim 13, in which said coded mode information includes bit rate information and sampling frequency information, said computer readable program code (F) has the computer readable program code of storing initial maximum scale factor band information having a plurality of scale factor bands in relation to the bit rate information and the sampling frequency information and Signal-to-Mask ratio threshold value information having a plurality of Signal-to-Mask ratio threshold values in relation to the bit rate information and the sampling frequency information, said computer readable program code (G) has the computer readable program code of calculating an initial maximum scale factor band for said audio signal on the basis of the result made by said computer readable program code (B) and said coded mode information including said bit rate information and said sampling frequency information inputted by said computer readable program code (D) with reference to said initial maximum scale factor band information and Signal-to-Mask ratio threshold value information stored by said computer readable program code (F), and said computer readable program code (H) has the computer readable program code of calculating a maximum scale factor band for said audio signal on the basis of said Signal-to-Mask ratio information calculated by said computer readable program code (E) and said initial maximum scale factor band calculated by said computer readable program code (G).

15.   An audio signal encoding computer program product as set forth in claim 14, in which said coded mode information further includes the number of channels, said computer readable program code (F) has the computer readable program code of storing initial maximum scale factor band information having a plurality of scale factor bands in relation to the number of channels and Signal-to-Mask ratio threshold value

48

information having a plurality of Signal-to-Mask ratio threshold values in relation to the number of channels, said computer readable program code (G) has the computer readable program code of calculating an initial maximum scale factor band for said audio signal on the basis of the result made by said computer readable program code (B) and said coded mode information including the number of channels inputted by said computer readable program code (D) with reference to said initial maximum scale factor band information and Signal-to-Mask ratio threshold value information stored by said computer readable program code (F), and said computer readable program code (H) has the computer readable program code of calculating a maximum scale factor band for said audio signal on the basis of said Signal-to-Mask ratio information calculated by said computer readable program code (E) and said initial maximum scale factor band calculated by said computer readable program code (G).

16.   An audio signal encoding computer program product as set forth in claim 13, in which said Signal-to-Mask ratio information includes a Signal-to-Mask ratio table showing a relationship between a plurality of Signal-to-Mask ratios and scale factor bands, said computer readable program code (F) has the computer readable program code of storing initial maximum scale factor band information and Signal-to-Mask ratio threshold value information, said computer readable program code (G) has the computer readable program code of calculating an initial maximum scale factor band and a Signal-to-Mask ratio threshold value for said audio signal on the basis of the result made by said computer readable program code (B) and said coded mode information inputted by said computer readable program code (D) with reference to said initial maximum scale factor band information and said Signal-to-Mask ratio threshold value information stored by said computer readable program code (F), and said computer readable program code (H) has the computer readable program code of calculating a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band and said Signal-to-Mask ratio threshold value calculated by said computer readable program code (G) in accordance with said Signal-to-Mask ratio table showing a relationship between Signal-to-Mask ratios and scale factor bands included by said Signal-to-Mask ratio information calculated by said computer readable program code (E) through the computer readable program codes of:

(H-1)   computer readable program code for determining a Signal-to-Mask ratio corresponding to a maximum scale factor band in accordance with said Signal-to-Mask ratio table wherein the initial value of said maximum scale factor band is said initial maximum scale factor band calculated by said computer readable program code (G);

(H-2)   computer readable program code for judging whether said Signal-to-Mask ratio determined by said computer readable program code (H-1) is greater than said Signal-to-Mask ratio threshold value;

(H-2-1) decrementing said maximum scale factor band by one and returning to said computer readable program code (H-1) if it is judged that said Signal-to-Mask ratio is not greater than said Signal-to-Mask ratio threshold value by said computer readable program code (H-2);

(H-3)   computer readable program code for repeating said computer readable program code (H-1) to computer readable program code (H-2-1) until it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value by said computer readable program code (H-2);

(H-4)   computer readable program code for incrementing said maximum scale factor band by one if it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value by said computer readable program code (H-2); and

(H-5)   computer readable program code for outputting said maximum scale factor band thus incremented by one by said computer readable program code (H-4) to said computer readable program code (I).

17.   An audio signal encoding computer program product as set forth in claim 13, in which said computer readable program code (F) has the computer readable program code of storing initial maximum scale factor band information and energy threshold value information, said computer readable program code (G) has the computer readable program code of calculating an initial maximum scale factor band and an energy threshold value for said audio signal on the basis of the result made by said computer readable program code (B) and said coded mode information inputted by said computer readable program code (D) with reference to said initial maximum scale factor band information and said energy threshold value information stored by said computer readable program code (F), and said computer readable program code (H) has the computer readable program code of calculating an energy value table showing a relationship between a plurality of energy values and scale factor bands on the basis of said frequency information generated by said computer readable program code (C), and calculating a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band and said energy threshold value calculated by said computer readable program code (G) with reference to said energy value table showing a relationship between energy values and scale factor bands through the computer

50

readable program codes of:

(H-1) computer readable program code for determining an energy value corresponding to a maximum scale factor band in accordance with said energy value table whereby said initial value of said maximum scale factor band is said initial maximum scale factor band calculated by said computer readable program code (G);

(H-2) computer readable program code for judging whether said energy value determined by said computer readable program code (H-1) is greater than said energy threshold value;

(H-2-1) computer readable program code for decrementing said maximum scale factor band by one and returning to said computer readable program code (H-1) if it is judged that said energy value is not greater than said energy threshold value by said computer readable program code (H-2);

(H-3) computer readable program code for repeating said computer readable program code (H-1) and computer readable program code (H-2-1) until it is judged that said energy value is greater than said energy threshold value by said computer readable program code (H-2);

(H-4) computer readable program code for incrementing said maximum scale factor band by one if it is judged that said energy value is greater than said energy threshold value by said computer readable program code (H-2), and

(H-5) computer readable program code for outputting said maximum scale factor band thus incremented by one by said computer readable program code (H-4) to said computer readable program code (I).

18. An audio signal encoding computer program product as set forth in claim 13, in which said Signal-to-Mask ratio information includes a Signal-to-Mask ratio table showing a relationship between a plurality of Signal-to-Mask ratios and scale factor bands, said computer readable program code (F) has the computer readable program code of storing initial maximum scale factor band information, Signal-to-Mask ratio threshold value information, and minimum scale factor band information, said computer readable program code (G) has the computer readable program code of calculating an initial maximum scale factor band, a Signal-to-Mask ratio threshold value, and a minimum scale factor band for said audio signal on the basis of the result made by said computer readable program code (B) and said coded mode information inputted by said computer readable program code (D) with reference to said initial maximum scale factor band information, said Signal-to-Mask ratio threshold value information, and said minimum scale factor band information stored by said computer readable program code

(F), and said computer readable program code (H) has the computer readable program code of calculating a maximum scale factor band for said audio signal on the basis of said initial maximum scale factor band, said Signal-to-Mask ratio threshold value, and said minimum scale factor band calculated by said computer readable program code (G) in accordance with said Signal-to-Mask ratio table showing a relationship between Signal-to-Mask ratio and scale factor bands included by said Signal-to-Mask ratio information calculated by said computer readable program code (E) through the computer readable program codes of:

(H-1) computer readable program code for determining a Signal-to-Mask ratio corresponding to a maximum scale factor band in accordance with said Signal-to-Mask ratio table wherein the initial value of said maximum scale factor band is said initial maximum scale factor band calculated by said computer readable program code (G);

(H-2) computer readable program code for judging whether said Signal-to-Mask ratio determined by said computer readable program code (H-1) is greater than said Signal-to-Mask ratio threshold value;

(H-2-1) computer readable program code for decrementing said maximum scale factor band by one if it is judged that said Signal-to-Mask ratio is not greater than said Signal-to-Mask ratio threshold value by said computer readable program code (H-2);

(H-3) computer readable program code for repeating said computer readable program code (H-1) to computer readable program code (H-2-1) until it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value by said computer readable program code (H-2);

(H-4) computer readable program code for incrementing said maximum scale factor band by one if it is judged that said Signal-to-Mask ratio is greater than said Signal-to-Mask ratio threshold value by said computer readable program code (H-2);

(H-5) computer readable program code for judging whether said maximum scale factor band thus incremented by one by said computer readable program code (H-4) is less than said minimum scale factor band;

(H-6) computer readable program code for incrementing said minimum scale factor band by one, replacing said maximum scale factor band with said minimum scale factor band thus incremented by one, and outputting said maximum scale factor band thus replaced to said computer readable program code (I) if is judged that said maximum scale factor band is less than said minimum scale factor band by said computer readable program code (H-5); and

(H-7) computer readable program code for outputting said maximum scale factor band to said computer readable program code (I) if it is judged that said maximum scale

52

factor band is not less than said minimum scale factor band by said computer readable program code (H-5).